Helping Massachusetts Municipalities Create a Greener Energy Future

Stretch Code Informational Session
May 18, 2011

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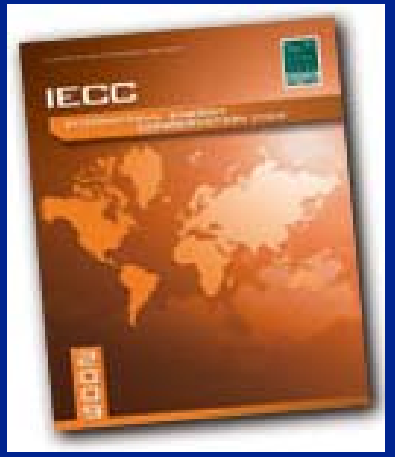
Topics

- IECC 2009 Overview
- What is the Stretch Code?
- Discussion and Q&A

Energy Codes in MA are changing

- New base energy code in July 2010 (IECC 2009)
  - Roughly 10-15% more efficient than IECC 2006
  - Next I-Code 1/1/2013-Designed to be 30% better
    - New phase of outcome-based Energy Codes
- Stretch Code appendix 115.AA
  - Approx 15-20% more energy efficient than the base code (IECC 2009/AHRAE 90.1 2007)



- Commercial bldgs. ASHRAE 90.1-2007 remains

ASHRAE 90.1 = *Energy Standard for Buildings Except Low-Rise Residential Buildings*
IECC = International Energy Conservation Code – of International Codes Council (ICC)

IECC and ASHRAE Codes

- ICC & ASHRAE develop model building codes and standards for the US.
- ICC: publishes IECC energy code
  - 3 year cycle IECC 2006, IECC 2009
- ASHRAE: publishes 90.1 standard
  - 3 year cycle 90.1-2007, 90.1-2010

IECC = International Energy Conservation Code – of International Codes Council (ICC)
ASHRAE = American Society of Heating, Refrigerating and Air-Conditioning Engineers

IECC 2009 and the MA 8th Edition

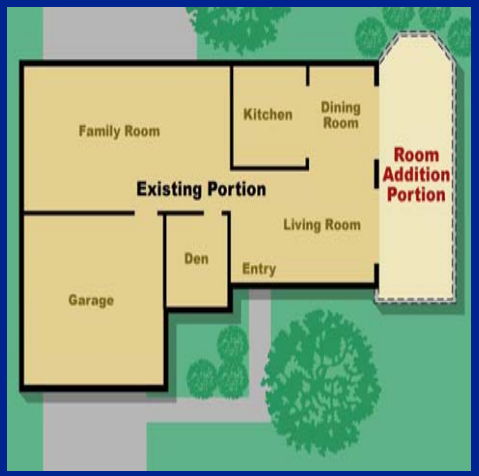
- IECC 2009 and the Stretch Appendix 115.AA Codes address energy only
- MA 8th Edition will address all codes (structural, plumbing, etc.)

What's Changed Since IECC 2006?

- **New requirements**
  - **Building envelope tightness**
  - **Duct testing**
  - **Lighting equipment**
    - Pool controls and covers
    - Snow melt controls
- No moisture control requirements (framed walls, floors and ceilings)

IECC 2009 Additions, Alterations, Renovations and Repairs

- Conform as relates to new construction
- Unaltered portion (s) do not need to comply
- Additions can comply alone or in combination with existing building
- Exceptions



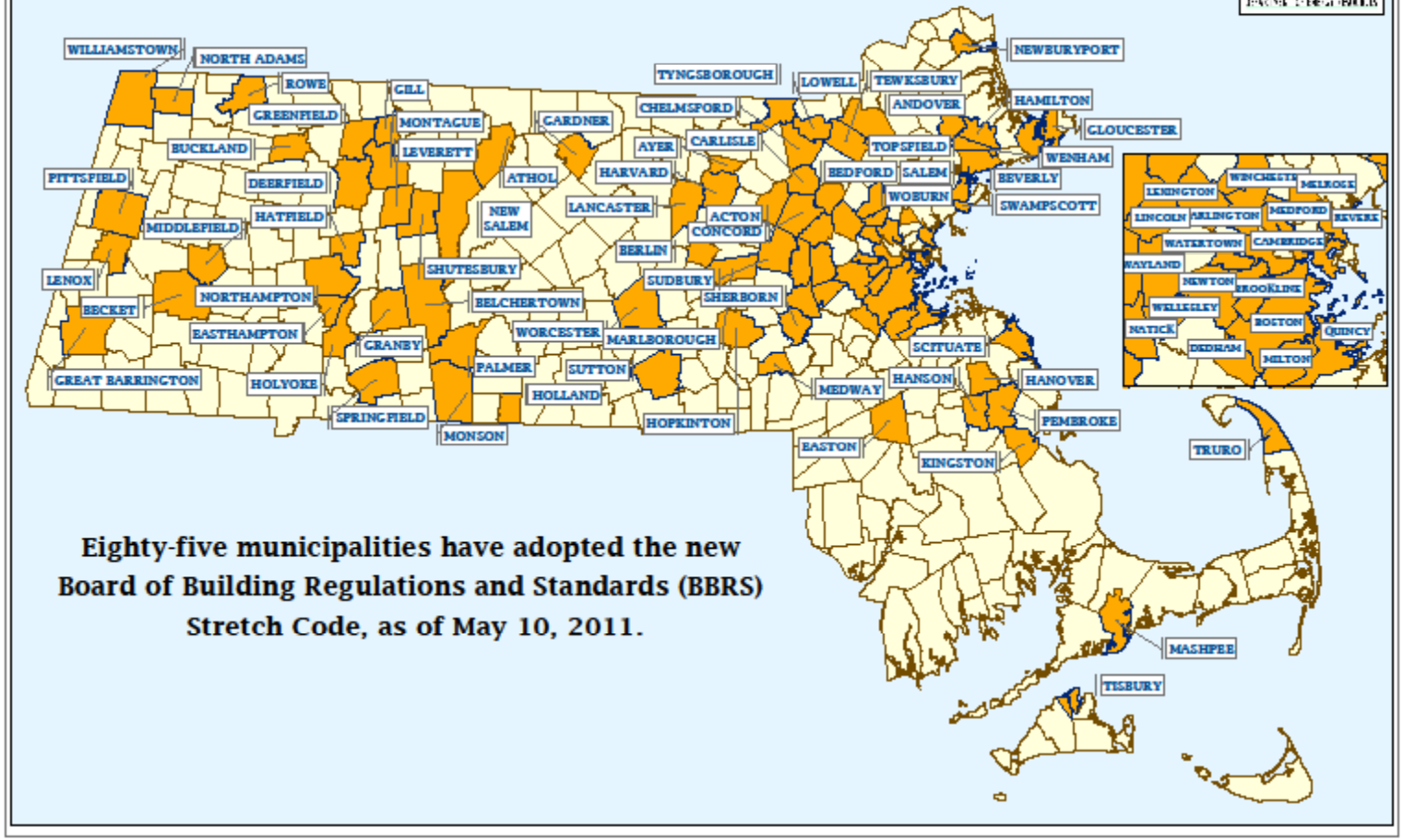
Mandatory Requirements Air Leakage Control

- Building envelope
  - Sealed with caulking materials or
  - Closed with gasketing systems
  - Joints and seams sealed or taped
  - Air permeable insulation is not used as air sealing material

STRETCH ENERGY CODE

APPENDIX 115.AA

Stretch Code Adoption, by Community



Eighty-five municipalities have adopted the new Board of Building Regulations and Standards (BBRS) Stretch Code, as of May 10, 2011.

Why an Optional Stretch Code?

- Growing desire to reduce costs, reduce dependency on imported fuels, and address climate change
- Several towns and cities asked for the ability to adopt stronger building codes
- BBRS developed one alternative code that is consistent across the state

What does the Stretch Code Apply to?

- Residential
  - New Construction
    - Performance Only
  - Additions
    - Performance /Prescriptive
  - Home Renovations
    - Performance /Prescriptive
- Historic Home Exemption
- Commercial
  (5,000-100,000 sq/ft)
  - New Construction
  - Additions
- Renovations Exempt

Residential Stretch Code: New Construction

Building category	Definition	Requirements based on energy performance (can do prescriptive instead where shown)	Alternative "prescriptive" requirement – specific efficiency measures
New residential	Single-family, multi-family of 3 stories or less	HERS index 65 above 3,000 ft^2, 70 below 3,000 ft^2, certified by HERS rater; follow Energy Star thermal bypass checklist	None
Residential additions	Expansions of existing living space	HERS 65 over 3,000 ft^2, HERS 70 below 3,000 ft^2; certified by HERS rater (or can choose prescriptive option at right)	Prescriptive option of Energy Star Homes program - same as residential rehab below
Major residential rehab/ alterations	Major alterations as in existing code – excludes storm windows, reroofing, doors, etc.	HERS 80 over 2,000 ft^2, HERS 85 under 2,000 ft^2; certified by HERS rater (or prescriptive option)	Prescriptive option of Energy Star Homes program; insulation equal to IECC 2009

Residential New Construction

Performance Path

- Performance Path is the only option
  - Uses Home Energy Rating System (HERS)
  - 70 or less < 3,000 sq ft.
  - 65 or less > 3,000 sq ft.
- Requires a certified HERS rater
  - Review building plans
  - Check insulation installation
  - Thermal bypass Checklist
  - Blower-door and duct testing

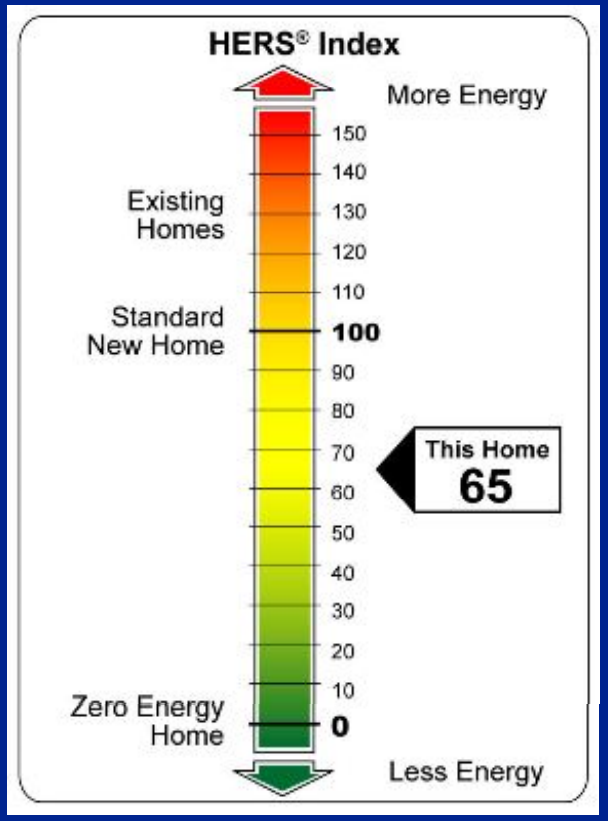
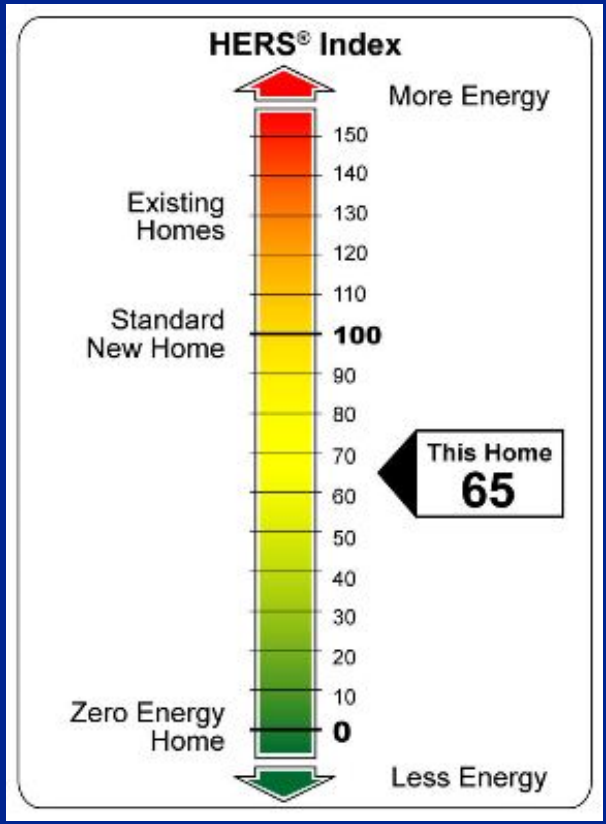


Image source: www.lexingtoninfrared.com/hers-ratings.php

What is a HERS Rating?

- Home Energy Rating System (HERS) Index
- Each home is tested, certified and labeled by an independent HERS Rating Company
  - Must follow Residential Energy Services Network (RESNET) testing procedures
  - A HERS Rater uses software to model the home's energy performance based on plan analysis and on-site testing to calculate a HERS Index. (Can be used instead of ResCheck)



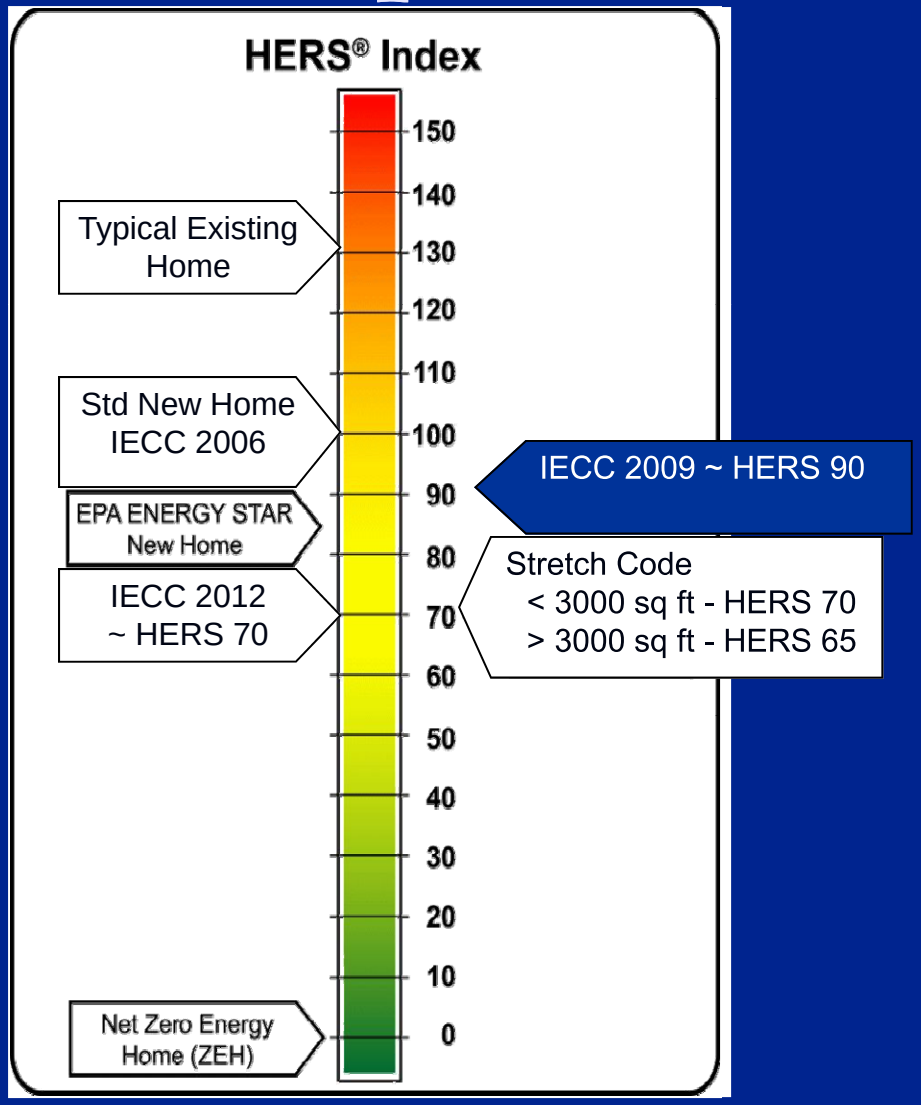
What is the Thermal Bypass Checklist?

ENERGY STAR Qualified Homes
Thermal Bypass Inspection Checklist

Home Address:_____City:_____State:_____

Thermal Bypass	Inspection Guidelines	Corrections Needed	Builder Verified	Rater Verified	N/A
1. Overall Air Barrier and Thermal Barrier Alignment	**Requirements:** Insulation shall be installed in full contact with sealed interior and exterior air barrier except for alternate to interior air barrier under item no. 2 *(Walls Adjoining Exterior Walls or Unconditioned Spaces)*				
	All Climate Zones:				
	1.1 Overall Alignment Throughout Home	☐	☐	☐	☐
	1.2 Garage Band Joist Air Barrier (at bays adjoining conditioned space)	☐	☐	☐	☐
	1.3 Attic Eave Baffles Where Vents/Leakage Exist	☐	☐	☐	☐
	Only at Climate Zones 4 and Higher:				
	1.4 Slab-edge Insulation (A maximum of 25% of the slab edge may be uninsulated in Climate Zones 4 and 5.)	☐	☐	☐	☐
	Best Practices Encouraged, Not Req'd.:				
	1.5 Air Barrier At All Band Joists (Climate Zones 4 and higher)	☐	☐	☐	☐
	1.6 Minimize Thermal Bridging (e.g., OVE framing, SIPs, ICFs)	☐	☐	☐	☐
2. Walls Adjoining Exterior Walls or Unconditioned Spaces	**Requirements:** • Fully insulated wall aligned with air barrier at both interior and exterior, **OR** • Alternate for **Climate Zones 1 thru 3**, sealed exterior air barrier aligned with RESNET Grade 1 insulation fully supported • Continuous top and bottom plates or sealed blocking				
	2.1 Wall Behind Shower/Tub	☐	☐	☐	☐
	2.2 Wall Behind Fireplace	☐	☐	☐	☐
	2.3 Insulated Attic Slopes/Walls	☐	☐	☐	☐
	2.4 Attic Knee Walls	☐	☐	☐	☐
	2.5 Skylight Shaft Walls	☐	☐	☐	☐
	2.6 Wall Adjoining Porch Roof	☐	☐	☐	☐
	2.7 Staircase Walls	☐	☐	☐	☐
	2.8 Double Walls	☐	☐	☐	☐

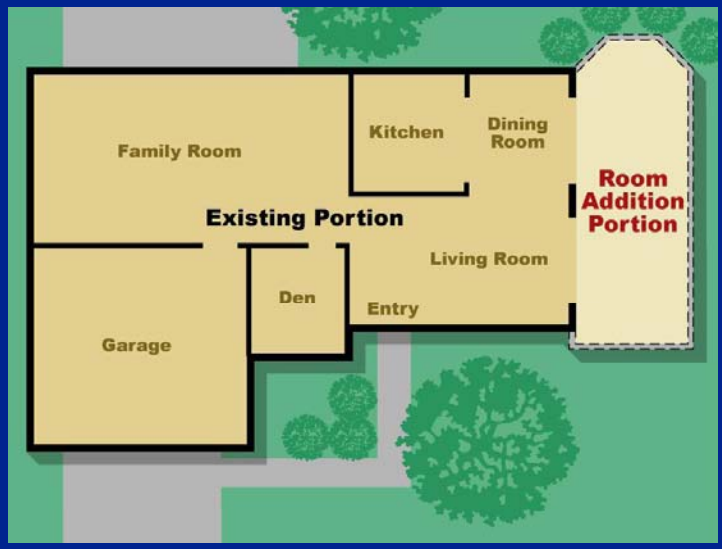
Stretch Code vs. IECC Comparison



Home Additions

Performance or Prescriptive Path
Addition Only

- Performance Path
  - 70 or less < 3,000 sq ft.
  - 65 or less > 3,000 sq ft.



Prescriptive Path

- ENERGY STAR Windows *(U=.30)*
- IECC 2009 insulation and envelope requirements
- Duct leakage under 4 cfm per 100 sq ft
- Builder Verified Thermal Bypass Checklist

Home Renovations

Performance or Prescriptive Path

- Performance Path is easier than for new construction and additions
  - Easier HERS index requirement (mostly relevant for gut-renovations)
  - 85 or less < 2,000 sq ft.
  - 80 or less > 2,000 sq ft.
- Prescriptive Path
  - Same as additions

Image source: http://www.wilkinsonbuild.co.uk/Portals/5/Renovation/renovation2.jpg

Stretch Code and ENERGY STAR

- The Stretch appendix almost puts the current ENERGY STAR Homes program into code
- ENERGY STAR is a proven cost-effective program
  - 31% in 2010 of new construction in MA
- Builder incentives/rebates
  - Incentives up to $8000,
  - Rebates on appliances,

  heating and cooling, lighting, etc.
- Builder training and materials
- Subsidized HERS raters
  - Third party verification

COMMERCIAL STRETCH CODE

Commercial 'Stretch' Appendix

- Addresses the construction of new commercial buildings and additions over 5,000 ft^2
- Two Options (depending on size)
  - Performance option - 20% below Code
  - Prescriptive option for most building types

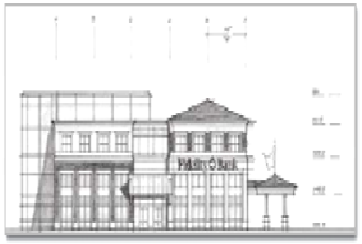
    5,000 - 100,000 ft2

Advanced Building Features

- High Efficiency T-5 Pendant Lighting
- Lighting Control Efficiency
- Reduced Lighting Power Density
- Efficient Site Lighting
- Additional Wall Insulation
- High Performance Glazing
- Efficient VAV RTU's, with ECM Motors
- Demand Control Ventilation
- Part Load HVAC Efficiency Enhancements

Funded Utility Services Support

- Early Life Cycle Cost Analysis
- Integrated Design Team Approach
- Commissioning



Project Description

The 47,000 SF Fidelity Bank Corporate Office and Branch was constructed as a design-build project in Leominster, MA. The four story building will provide office space plus a ground floor branch bank office. This project is acclaimed for its highly successful implementation of the national Advanced Buildings program. The project demonstrates the validity of the Advanced Buildings program assertions. The guideline cost effectively delivered even more than the expected 20% to 30% reduction in annual energy costs compared to a code based design.

Envelope Improvements

- Walls: Added 3-1/2" batt insulation to planned 2" rigid.
- Glazing:
  - Upgrade U value from 0.42 to 0.31
  - Upgrade SHGC from 0.50 to 0.30
- Projected envelope savings: $1,500

Project Team

Owner:
Fidelity Bank

Project Management:
Habitat Advisory Group

Architect:

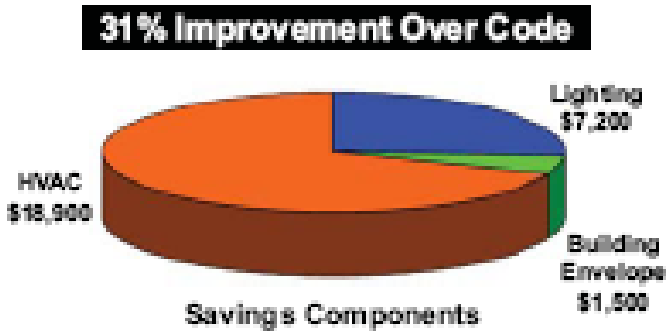
High Performance Building Design Uses 31% Less Energy

Savings Projection

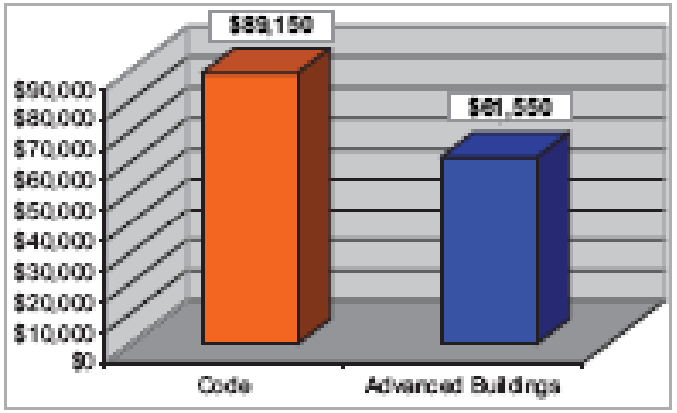
Annual Energy Savings:	$ 27,600
Additional Cost for Upgrades:	$100,622
Utility Incentives:	- $ 66,587
Net Owner Costs:	$ 34,035

Payback with Incentives: 1.2 years ROI: 83%

Payback without Incentives: 3.7 years ROI: 27%



Savings Components
($27,600 annual savings)



Annual Energy Costs

Lighting Savings Summary

The lighting layout consisted mainly of T-5 pendants in open office areas, and the latest generation of recessed T-5 fixtures in the remaining areas.

Projected Lighting Savings: $7,200

	Mass Energy Code	Advanced Buildings Criteria	Final Design	% Reduction
Lighting Power Density	1.34 w/SF	0.96 w/SF	0.86 w/SF	36%

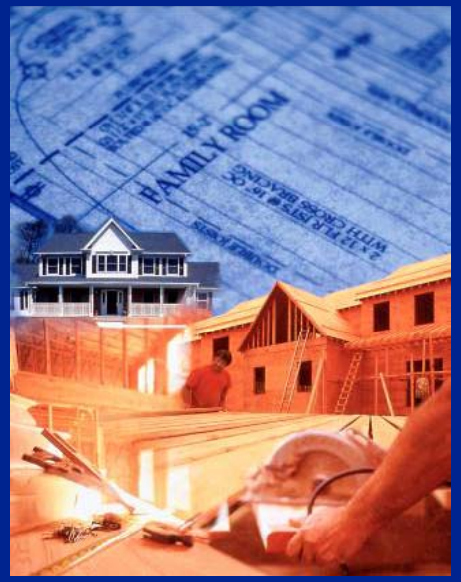
Improved lighting quality while using less energy!

Compliance

Codes and Training

Code Compliance & Inspections

- Essentially the same as base code
- Code Official has the same authority
  - Same building inspections
  - Approves building documents, Energy Star and HERS rating or ASHRAE modeling as documentation of energy compliance



Training on new energy codes

- Covering both the IECC 2009 & Stretch code
- Provided free to all Code Officials
  - Includes IECC code book and Stretch appendix
- Provided at cost to building professionals
- Register online: www.cetonline.org/Events/events.php
  - Separate Commercial and Residential sessions
- Energy star homes training available for free: www.energystarhomes.com/
- Utilities offer commercial 'Core Performance' energy training

Stretch Code Case Studies

Massachusetts Stretch Code Improvement - Cash Flow

Baseline Home (2,672 sf)

	IECC 2009 Code	Stretch Code	Stretch Code - with ENERGY STAR[4,5] -
HERS Index Modeled in REM/Rate	86	70	70
Improvement Measures (changes relative to Basecase)	- Unconditioned basement - Floor, R30 - Walls, R21 - Ceiling, R38 G2 - Heating, 80 AFUE - Cooling, 13 SEER - Water Heating, .59 EF - Duct leakage, 8% - Infiltration, 7 ACH50 - Efficient lighting, 50%	- Ceiling, R38 G1 - Heating, 94 AFUE - Water heating, .62 EF - Infiltration, 4 ACH50 - Efficient lighting, 75% - Exhaust Only Ventilation	- Ceiling, R38 G1 - Heating, 94 AFUE - Water heating, .62 EF - Duct leakage, 6% - Infiltration, 5 ACH50 - Efficient lighting, 80% - Exhaust Only Ventilation
Improvement Costs		$ 2,049	$ 2,155
HERS Rater Fee[1]		$ 900	$ 900
HERS Rater reimbursement[2]		-	$ (650)
ENERGY STAR Incentive[3]		-	$ (650)
Total Improvement Costs		$ 2,949	$ 1,755
Mortgage Interest Rate		6%	6%
Loan Term (Years)		30	30
Annual Incremental Mortgage Payment		$ 214	$ 127
Annual Energy Costs[6]	$ 3,970	$ 3,463	$ 3,454
Annual Energy Savings from Baseline		$ 507	$ 516
Annual Cash Flow	**$ -**	**$ 293**	**$ 389**

[1] Estimated Massachusetts ENERGY STAR Homes Program HERS Rater Fee (Range is from $750-$1500, but typically close to $750). Includes cost for conducting Thermal Bypass Inspection

[2] HERS Rater Fees are reimbursed by the Massachusetts ENERGY STAR Homes program by between $650-900 per unit, depending upon the HERS rating achieved.

[3] Massachusetts ENERGY STAR Homes Program may receive a minimum incentive of $650.

[4] ENERGY STAR requirements have been added to the Stretch Code package.

[5] Stretch code homes may qualify for of $1250 where the HERS rating is ~65 or lower

[6] Annual energy costs are based on most recently available fuel costs, from November 2009. Costs for heating are based on natural gas prices, the least expensive heating fuel. With oil, savings would increase.

Massachusetts Stretch Code Improvement - Cash Flow

Large Home (4,462 sf)

	IECC 2009 Code	Stretch Code	Stretch Code - with ENERGY STAR[4,5] -
HERS Index Modeled in REM/Rate	92	65	65
Improvement Measures (changes relative to Basecase)	- Unconditioned basement - Floor, R30 - Walls, R21 - Ceiling, R38 G2 - Heating, 80 AFUE - Cooling, 13 SEER - Water Heating, .59 EF - Duct leakage, 8% - Infiltration, 7 ACH50 - Efficient lighting, 50%	- Ceiling, R60 G1 - Heating, 94 AFUE - Water Heating, .62 EF - Duct Leakage, 6% - Infiltration, 3 ACH50 - Efficient Lighting, 90% - Exhaust Only Ventilation	- Ceiling, R60 G1 - Heating, 94 AFUE - Water Heating, .62 EF - Duct Leakage, 6% - Infiltration, 3 ACH50 - Efficient Lighting, 90% - Exhaust Only Ventilation
Improvement Costs		$ 5,576	$ 5,576
HERS Rater Fee[1]		$ 900	$ 900
HERS Rater reimbursement[2]		-	$ (650)
ENERGY STAR Incentive[3]		-	$ (650)
Total Improvement Costs		$ 6,476	$ 5,176
Mortgage Interest Rate		6%	6%
Loan Term (Years)		30	30
Annual Incremental Mortgage Payment		$ 471	$ 376
Annual Energy Costs[6]	$ 6,510	$ 5,055	$ 5,055
Annual Energy Savings from Baseline		$ 1,455	$ 1,455
Annual Cash Flow	**$ -**	**$ 984**	**$ 1,079**

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Massachusetts Stretch Code Improvement - Cash Flow

Small Home (1,708 sf)

	IECC 2009 Code	Stretch Code	Stretch Code - with ENERGY STAR[4,5] -
HERS Index Modeled in REM/Rate	86	70	70
Improvement Measures (changes relative to Basecase)	- Unconditioned basement - Floor, R30 - Walls, R21 - Ceiling, R38 G2 - Heating, 80 AFUE - Cooling, 13 SEER - Water Heating, .59 EF - Duct leakage, 8% - Infiltration, 7 ACH50 - Efficient lighting, 50%	- Ceiling, R60 G1 - Heating, 94 AFUE - Water Heating, .62 EF - Infiltration, 5 ACH50 - Efficient lighting, 75% - Exhaust Only Ventilation	- Ceiling, R60 G1 - Heating, 94 AFUE - Water Heating, .62 EF - Infiltration, 5 ACH50 - Duct leakage, 6% - Efficient lighting, 80% - Exhaust Only Ventilation
Improvement Costs		$ 3,262	$ 3,643
HERS Rater Fee[1]		$ 900	$ 900
HERS Rater reimbursement[2]		-	$ (650)
ENERGY STAR Incentive[3]		-	$ (650)
Total Improvement Costs		$ 4,162	$ 3,243
Mortgage Interest Rate		6%	6%
Loan Term (Years)		30	30
Annual Incremental Mortgage Payment		$ 302	$ 236
Annual Energy Costs[6]	$ 3,754	$ 3,171	$ 3,159
Annual Energy Savings from Baseline		$ 583	$ 595
Annual Cash Flow	**$ -**	**$ 281**	**$ 359**

[1] Estimated Massachusetts ENERGY STAR Homes Program HERS Rater Fee (Range is from $750-$1500, but typically close to $750). Includes cost for conducting Thermal Bypass Inspection

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Massachusetts Stretch Code Improvement - Cash Flow

Cambridge Triple Decker (5,136 sf)

	IECC 2009 Code	Stretch Code
HERS Index Modeled in REM/Rate	**92**	**85**
Improvement Measures (changes relative to Basecase)	- Unconditioned basement - Foundation Walls, R0 - Frame Floor, R30 - Walls, R13 - Ceiling, R38 G2 - Heating, 80 AFUE - Water Heating, .59 EF - Infiltration, 7 ACH50 - Efficient lighting, 50%	- Infiltration, 4.5 ACH50 - Efficient Lighting, 75% - Exhaust Only Ventilation
Improvement Costs		$ 2,202
HERS Rater Fee1		$ 900
Total Improvement Costs		$ 3,102
Mortgage Interest Rate		6%
Loan Term (Years)		30
Annual Incremental Mortgage Payment		$ 225
Annual Energy Costs2	$ 6,828	$ 6,263
Annual Energy Savings from Baseline		$ 565
Annual Cash Flow	**$ -**	**$ 340**

Notes

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Questions?